tical phases of botany. The reduction of the space given to plant associations to thirty pages leaves this topic more nearly within the bounds in which it should be found in a general elementary course in botany. But the most important of all the new features of the book is its general plan of organization: first a general introduction to plant structures and functions by the use of the most accessible and best known plants; second upon this foundation follows a presentation of groups in logical order, a knowledge of structure being that around which a knowledge of use and adjustment is arranged, this being done, however, without classifying the different phases definitely into morphology, physiology, and systematic botany; and thirdly, a presentation of special phases of plant life follows the laying of general foundations.—OTIS W. CALDWELL.

Water plants

The literature pertaining to water plants promises to be greatly enriched through a series of studies by GLÜCK.[3] The first volume (unhappily called *Erster Teil*, though a book in itself, the second "part" being likewise an independently paged volume) deals with European Alismaceae, of which 8 species, representing 5 genera, were studied. This study differs from that of SCHENCK, SAUVAGEAU, and others, in that while they have specially treated the anatomical or geographical aspects, the emphasis here is chiefly on the biological side and by experimental methods. This shifting from the static to the dynamic is in harmony with the present trend of investigation. The book will be of interest to the ecologist and morphologist, and has as well a message for the systematist.

Part I of this first volume is descriptive of the experiments. Plants were studied in various relations to water, the cultures approximating all ordinary conditions of the uncultivated state. Typical of the author's methods is his treatment of *Alisma Plantago*. He studied first the land forms and those growing in water of various depths. Records were kept of macroscopic observations, measurements of parts, and peculiarities of behavior. Land-grown seedlings were then subjected to various aquatic conditions, even to submergence at depths as great as four meters. Older land plants were also subjected to similar experiments. Both, under certain conditions, determined by size of plant and amount of stored food, took on the form of leaf usually characteristic of the habitat. In some experiments water plants were transformed to land forms. There were also observations on the influence of habitat on the formation of flowers and fruit, and the conditions in which plants pass the winter.

While the results demonstrate the remarkable plasticity of these forms, there seem, however, to be rather definite limits to their variability. For example, the experiments seem to have established the correctness of the old division of *A.*

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3 GLÜCK, HUGO, Biologische und morphologische Untersuchungen über Wasser- und Sumpfgewächse. Erster Teil: Die Lebensgeschichte der europäischen Alismaceen. 8vo. pp. xxiv+312. *pls.* 7. *figs.* 25. Jena: Gustav Fischer. 1905. *M* 20.

Plantago L. into two distinct species, as it was impossible, even by long continued cultures, to transform one into the other.

Upon five of the forms special experiments to determine the influence of light were conducted. In general, however, the variable factor was the water relation, and this of course exercised some influence on numerous other relations. To change the degree or depth of submergence of a plant may not only alter the water relation, but cause as well differences in pressure, light, temperature, air, etc. It seems unfortunate that in all this study there was no exact attack upon certain of these factors individually, instead of the consideration of *ensemble* effects. Anatomical studies, too, would have been of interest, but the author felt he could not undertake the task at this time.

Part II is a summary of results. The plants are classed, without regard to systematic relations, into four habitat groups, viz.: land forms, shallow water forms, floating forms, and submerged forms. Each of these habitat groups is characterized by a certain type of leaf, though they of course intergrade. Each of these four dominant leaf types is discussed in relation to the environment producing it, especially the water relation. The optimum condition for general development was usually found to be shallow water. One plant, however, *Echinodorus ranunculoides repens*, grew best on land.

In discussing the flowering habits of aquatic plants the author notes that the land and shallow water forms flower more freely, and he suggests a relationship between the leaf tvpes and the flowering habits. It would seem, however, that the explanation might be readily thrown back, at least to the factors that produced the various leaf types.

Three of the Alismaceae studied were able to develop flowers and to open them while wholly submerged. On bright days these flowers were observed to open in the water, each surrounded by a bubble of gas. Only one of these, *A. graminifolium*, was able to develop and ripen seeds without coming to the surface.

Metamorphosis of flowering shoots into leafy axes was accomplished by changing the habitat. In *Elisma natans* and *Echinodorus repens* the amount of metamorphosis was immediately correlated with degree of submergence. Beyond a certain depth only vegetative structures were developed.

Under the head of formative factors the chief external influences discussed are those of water as such, depth of water, air, temperature, and light. The consideration of internal factors is limited to one—the quantity of reserve food.

The author concludes with a summary, in Latin, of his systematic conceptions of the forms studied.—ROBERT B. WYLIE.

The second volume[4] is concerned with the Utricularias of central Europe, the formation of turions by water plants, and Ceratophyllum. GLÜCK finds,

[4] GLÜCK, HUGO, Biologische und morphologische Untersuchungen über Wasser- und Sumpgewächse. Zweiter Teil: Untersuchungen über die mitteleuropäischen Utricularia-Arten; über die Turionenbildung bei Wasserpflanzen, sowie über Ceratophyllum. 8vo. pp. xviii+256. *pls. 6 + figs. 28.* Jena: Gustav Fischer. 1906. *M.* 18.

apparently with some surprise, that the morphology of Utricularia shoots can be best understood by considering the leaf and the axis homologous and equivalent structures—a point of view perhaps not so novel to others. Various forms, dependent on habitat, are described in the six recognized species. The so-called rhizoids, really modified shoots, arising from the base of the inflorescence, are partly anchoring and partly nutritive organs. Aerial shoots from water forms assist in gaseous exchange.

The formation and behavior of turions (special buds which become detached) is examined in a considerable range of water plants (*Elodea canadensis*, *Stratiotes aloides*, *Hydrilla verticillata*, *Myriophyllum verticillatum*, *Utricularia* (6 spp.), *Aldrovandia vesiculosa*, *Caldesia parnassifolia*, *Potamogeton* (7 spp.), and *Hydrocharis morsus-ranae*), and the structures are figured. The formation of these buds, usually in autumn in consequence of lowered temperature, may also be brought about by other unfavorable conditions. Growth may be resumed in autumn, but usually they hibernate in the water. Some withstand freezing in ice or mud; most are killed by it. As reproductive and hibernating structures the turions replace seeds largely, since the habitat of water plants is unfavorable to seed-forming.

Regeneration phenomena examined in Utricularia were referred to "correlation," the accumulation of plastic material at certain points causing the *Neubildung*.

Ceratophyllum, which has been widely believed to be a free swimming plant, is shown to be originally anchored by "rhizoids" (peculiarly modified shoots 6–25^{cm} long), which are also permeable to food materials.

New forms are described and the general results of the study are applied to the taxonomy of the plants.

Want of an index in both volumes, beyond mere names of plants, makes the facts gathered difficult of access. When will authors learn that they owe to themselves, if not to other users of their work, the drudgery of index making?—C. R. B.

MINOR NOTICES

Contributions of U. S. National Museum.—The current issue of this series contains the fifth paper by ROSE[5] under the title "Studies of Mexican and Central American plants." It also represents the fifth journey of Dr. ROSE to Mexico, which has enabled him to write with a large field experience. The numerous plates, some of them reproductions of photographs, bring the plants vividly to the eye. Four new genera are described, as follows: *Calibanus* (Liliaceae), *Sphinctospermum* (Viciaceae), *Pseudoxalis* (Oxalidaceae), *Escontria* (Cactaceae). The four following genera have been reestablished: Beaucarnia (Liliaceae), Odonia (Viciaceae), Biophytum (Oxalidaceae), Terebinthus (Balsameaceae).

[5] ROSE, J. N., Studies of Mexican and Central American plants. No. 5. Contrib. U. S. Nat. Herb. **10**: 79–132. *pls. 16–43.* 1906.